E. FRANKLIN.

ENGINE.

APPLICATION FILED AUG. 14, 1907.

923,505.

Patented June 1, 1909.

3 SHEETS—SHEET 1.

Fig. 1.

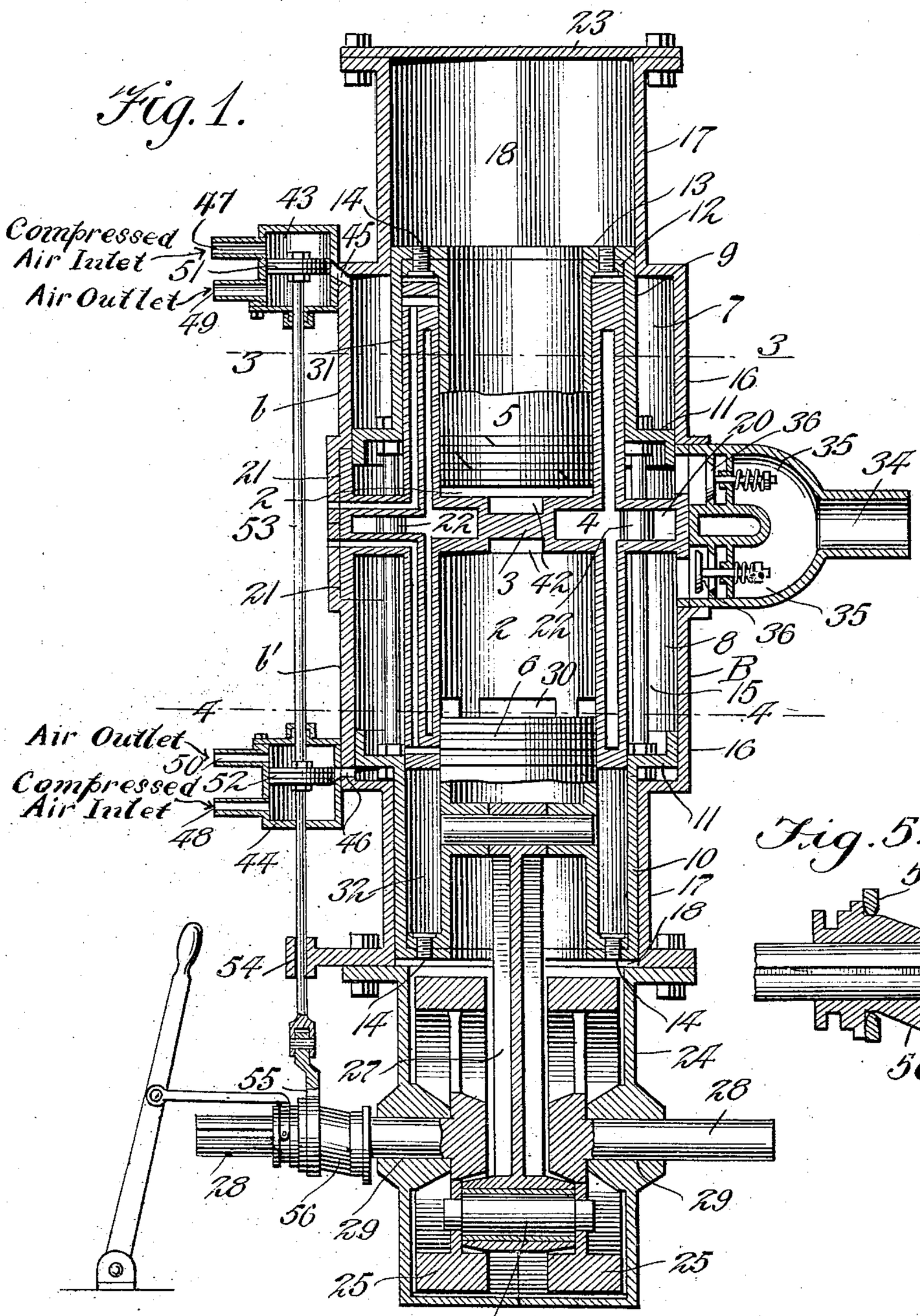

Fig. 5.

Witnesses

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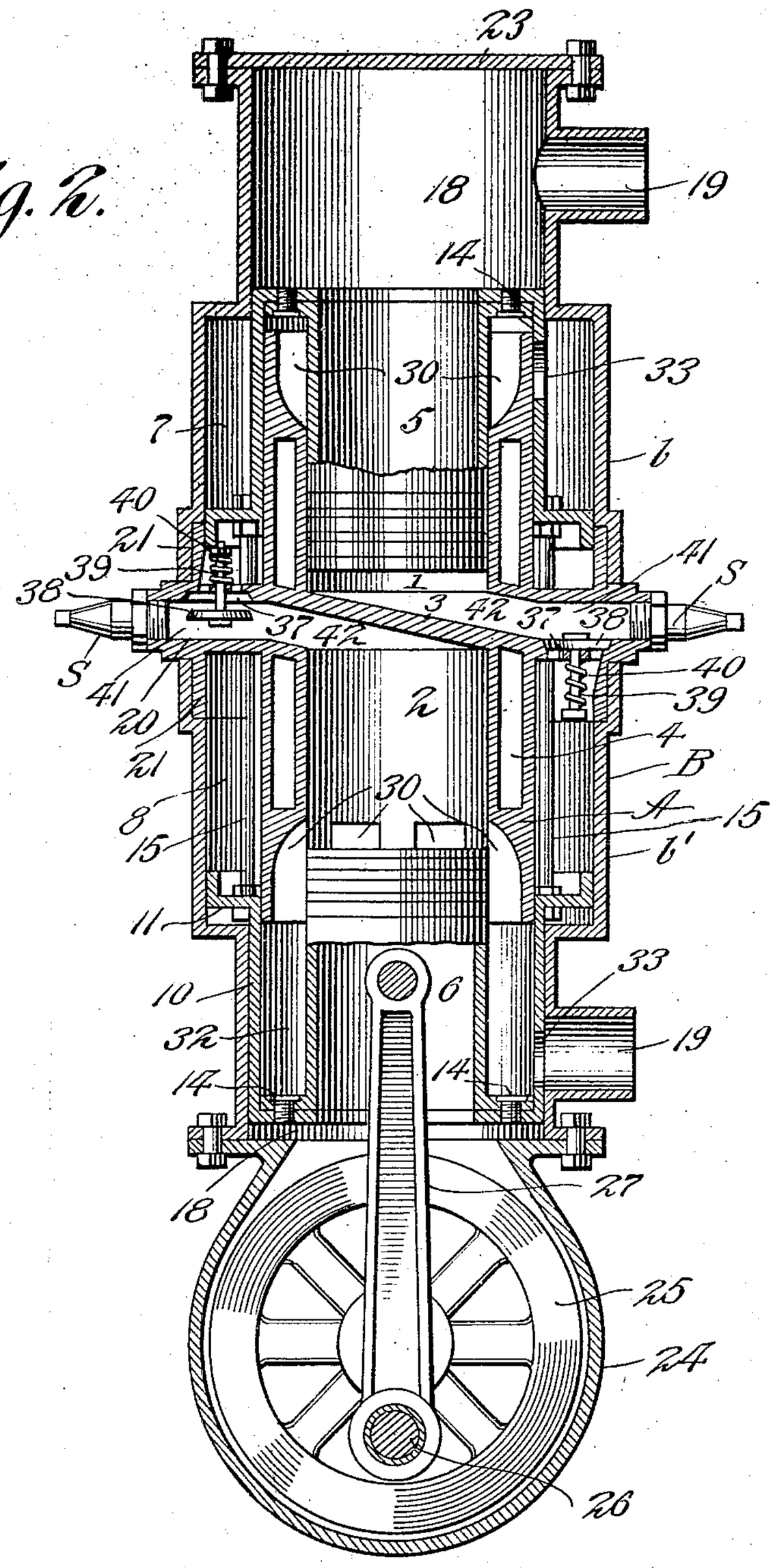
3 SHEETS—SHEET 2.

Fig. 2.



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3 SHEETS—SHEET 3.

Fig. 3.

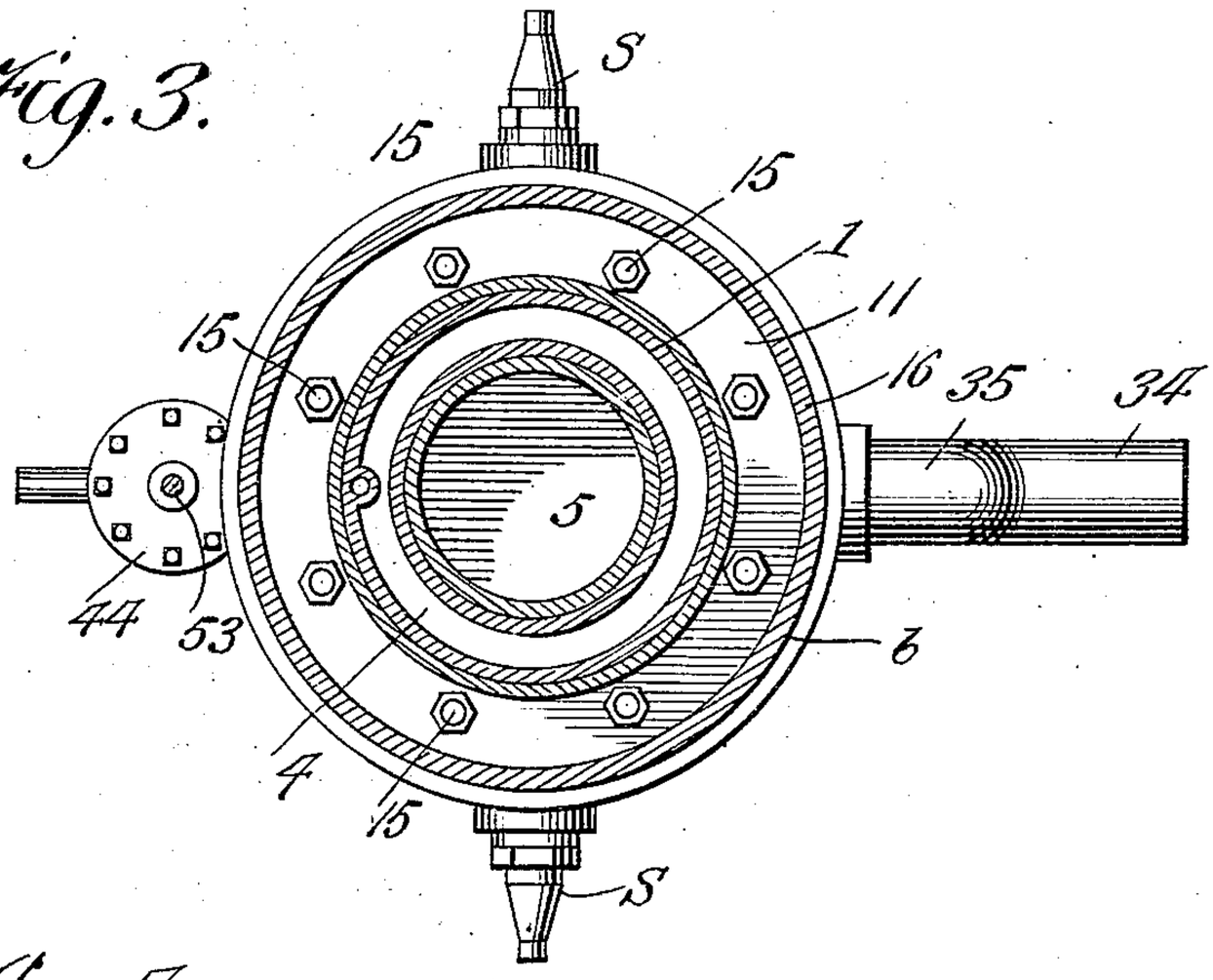
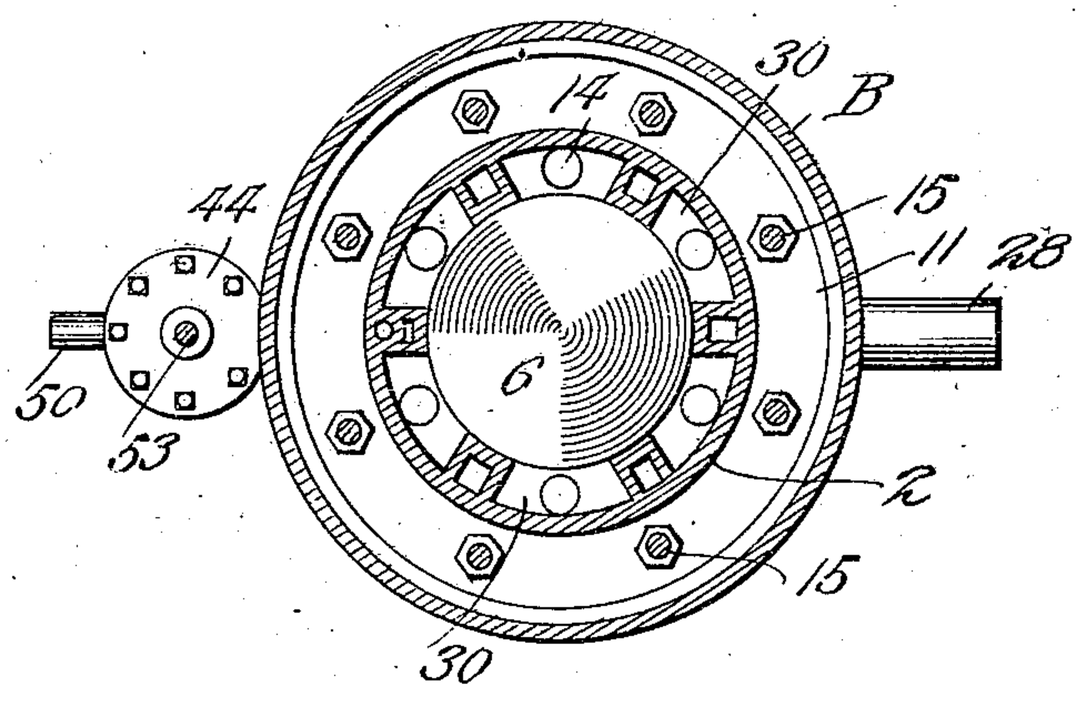


Fig. 4.



Witnesses

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UNITED STATES PATENT OFFICE.

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ENGINE.

No. 923,505. Specification of Letters Patent. Patented June 1, 1909.

Application filed August 14, 1907. Serial No. 388,536.

To all whom it may concern:

Be it known that I, ERNEST FRANKLIN, a citizen of the United States, residing at Portland, in the county of Multnomah and State of Oregon, have invented new and useful Improvements in Engines, of which the following is a specification.

This invention relates to internal combustion engines of the two-cycle type and more particularly to that style of engine in which oppositely disposed pistons are employed to receive alternate explosions for producing two impulses for each revolution of the crank shaft of the engine, there being pumps embodied in the organization of the engine for delivering the explosive charges to the piston cylinders.

The invention has for one of its objects to improve and simplify the construction and operation of apparatus of this character so as to be comparatively easy and inexpensive to manufacture, and thoroughly reliable and efficient in use.

A further object of the invention is the provision of a device especially adapted for the engine whereby the working parts can be set into operation when it is desired to start the engine, by means of air or other fluid under pressure, the said device being so designed as to permit the engine to be operated in either direction.

A still further object of the invention is the provision of an engine comprising pairs of oppositely disposed working and pump pistons and cylinders therefor, and automatically actuated valves for admitting the charges of explosive mixture to the pump cylinders and to the working cylinders from the pumps, the exhaust of the spent gases being conducted off through piston-covered ports in the working cylinders.

With these objects in view and others, as will appear as the description proceeds, the invention comprises the various novel features of construction and arrangement of parts which will be more fully described hereinafter and set forth with particularity in the claims appended hereto.

In the accompanying drawings, Figure 1 is a central longitudinal section of the engine taken in a plane parallel with the crank shaft. Fig. 2 is a similar section taken at right angles to the section of Fig. 1. Fig. 3 is a transverse section on line 3—3, Fig. 1. Fig. 4 is a transverse section on line 4—4, Fig. 1. Fig. 5 is a sectional view of the valve-actuating eccentric.

Similar reference characters are employed to designate corresponding parts throughout the several views.

Referring to the drawings, A designates a metal casting formed with oppositely disposed working cylinders 1 and 2 that are separated by an integral head 3, the walls of the cylinders and the head being hollow to provide a water space 4, whereby the parts can be cooled to the proper temperature. In the cylinders 1 and 2 are power pistons 5 and 6 which are suitably connected to reciprocate together. The exterior surface, as well as the interior surface of each cylinder is accurately turned, and around the body A is a cylindrical casing B which coöperates with the body A to form pump chambers 7 and 8 for receiving the mixture from a suitable source and conducting it into the working cylinders. Operating in the pump chambers are pistons 9 and 10 each in the form of a cylinder provided with a peripheral flange 11 forming an annular head at the inner end thereof, and the cylindrical bodies of the pump pistons are of such diameter as to have a working fit with the exterior of the working cylinders. The pump pistons are concentric with the working pistons and are preferably made separate therefrom, the working pistons having external flanges 12 at their outer ends that extend under internal flanges 13 on the pump pistons and are secured thereto by screws or other fastenings 14 passing through tapped openings in the said flanges. The pump pistons are connected together by spaced rods 15 extending parallel with the axis of the engine cylinders and having their ends fastened to the heads 11 of the pistons, whereby all of the pistons are rigidly connected together to move as a unitary structure.

The casing B of the engine is preferably constructed in two symmetrical parts *b* and *b'*, each part consisting of a cylinder 16 of large diameter to form a pump chamber and a cylinder 17 of smaller diameter to form a chamber 18 into which the adjacent working piston moves on its out stroke, each chamber having an outlet 19.

The body A is formed with a central web 20 contiguous with the head 3 which separates the pump chambers 7 and 8, and on this web are oppositely extending annular

flanges 21, and the inner ends of the casing sections *b* and *b'* fit over these flanges and are suitably secured thereto. The web 20 is hollow to communicate with the water space 4 and the said web is cast with apertured bosses 22 through which the connecting bars 15 move. The upper chamber 18 is closed by a plate 23, while the lower chamber 18 communicates with the crank casing 24. In the crank chamber 4 are crank wheels 25 carrying a crank pin 26 to which is attached a connecting rod 27, the upper end of the rod being connected with the lower piston 6. The wheels 25 are provided with shafts 28 that are journaled in bearings 29 formed on the crank casing 24. At the ends of the cylinders 1 and 2 are exhaust ports 30 that are covered and uncovered by the pistons and these ports communicate with the annular spaces 31 and 32 between adjacent power and pump pistons, and each pump piston has an exhaust outlet 33 communicating with the said annular exhaust receiving chambers and adapted to register with the outlets 19 of the chambers 18 when either piston is at the end of its outward stroke.

Communicating with the chambers 7 and 8 at points adjacent the web 20 is a branched conduit 34 that is intended to be connected with a carbureter to supply the mixture charges to the pumps, there being in each branch 35 an automatic suction valve 36 for permitting a charge to be drawn into the adjacent pump cylinder as the piston thereof moves outwardly and which closes during the in-stroke of the said piston. The charges, after being compressed by the pumps, are admitted to the working cylinders through inlet ports 37, which ports are closed by valves 38. The ports are so arranged that the charge compressed in the lower pump will be delivered to the upper working cylinder and the charge compressed in the upper pump admitted to the lower working cylinder. The discharge valve 37 of the pumps are provided with stems 39 extending into the cylinders of the respective pumps so as to be engaged by the pistons at the inner end of the stroke for the purpose of automatically opening the valves at the proper point to admit the compressed charges into the working cylinders, there being compression springs 40 on the valve stems for automatically seating the valve as the pistons move out of engagement with the stems. The ports 37 lead into the intake chambers 41 formed in the web 20 and each chamber 41 connects with its adjacent working cylinder by an inclined passage 42 cast or otherwise formed in the head 3.

An engine constructed and organized as described, is especially adapted for starting by means of fluid under pressure and is also capable of operating in either direction. The starting and reversing device employed for this purpose comprises valve casings 43 and 44 connected respectively, by ports 45 and 46 with the outer ends of the chambers 7 and 8, so that fluid under pressure can be admitted to said chambers to operate on the outer faces of the pump heads 11 of the pump pistons. The valve casings 43 and 44 are provided with inlets 47 and 48 that are suitably connected with air or any other suitable fluid under pressure and are also provided with outlets 49 and 50. In the casings are piston valves 51 and 52 that are adapted to open and close the ports 45 and 46 and these valves are mounted on a reciprocating rod 53 that passes through a guide 54 on a suitable part of the engine and carries an eccentric strap 55 which coöperates with the reversing eccentric 56 shiftable on the crank shaft 28 for manipulating the valve to control the direction of rotation of the engine. The valves 51 and 52, the ports controlled thereby, and the operating connections are so arranged that when it is desired to start the engine, either one of the ports 45 or 46 will be uncovered so that fluid under pressure can pass freely through either valve casing to operate on the outer faces of the pistons 11 to impart movement to the reciprocating element of the engine, it being understood that the reciprocating element formed by the pistons tends to come to rest at a central point so that the crank will not be on a dead center, this being due to the high compression in either one of the working cylinders operating to prevent either one of the pistons from stopping at the inner end of its stroke. By adjusting the eccentric 56, the valves can be operated to admit the starting fluid to act on either one of the outer faces of the pistons 11, according to the direction of movement of the engine desired. After the engine is started, the eccentric can be shifted so that the eccentric strap will be at the middle or neutral part of the eccentric, with the result that the valves 51 and 52 will remain stationary in such a position as to prevent the entrance of air to the chambers to act on the outer faces of the pistons 11. After the engine is started in this manner, a charge is drawn into one of the pumps during the initial stroke and then compressed on the next stroke, when a charge is drawn into the other pump. At the end of the compression stroke for the first charge, the valve 38 is caused to open to admit the charge into the companion working cylinder when the piston thereof has its exhaust ports uncovered. On the succeeding stroke, the charge admitted to the working cylinder is compressed and at the same time a new charge admitted to the other working cylinder, and at the end of this stroke, the compressed charge is fired so as to produce an impulse. In this manner, the pumps alternately supply the charges to the working cylinders wherein the charges are fired alternately, the firing being effected

by spark plugs S in the usual manner. The spent gases escape from the working cylinders when the ports 30 are uncovered and pass into the annular exhaust chambers 31 and 32 and thence to a point of final exhaust through the ports 33 and outlets 19.

When it is desired to operate the engine with compressed air or the like, as when the engine is carrying an extra heavy load, the eccentric 56 is adjusted to such a position as to cause the valves 51 and 52 to alternately admit air or other fluid under pressure to the pump cylinders to act against the outer sides of the pistons 11. In this manner, the elastic fluid will supplement the exploded gases in the working cylinders in driving the pistons, and thus augment the power of the engine.

From the foregoing description, taken in connection with the accompanying drawings, the advantages of the construction and of the method of operation will be readily apparent to those skilled in the art to which the present invention appertains, and while I have described the principle of operation of the invention, together with the apparatus which I now consider to be the best embodiment thereof, I desire to have it understood that the apparatus shown is merely illustrative and that such changes may be made when desired, as are within the scope of the claims.

Having thus described the invention, what I claim is:—

1. In an engine, the combination of a pair of oppositely disposed cylinders having a common head, a casing around the cylinders coöperating therewith to form annular pump chambers, valve controlled inlets communicating with the pump chambers, working pistons in the cylinders, pump pistons fitting the outside of the cylinders and working in the said chambers and each arranged concentrically around the working piston, means for detachably connecting the pump pistons with the adjacent working pistons, members for connecting the pump pistons whereby the pistons move together as a unitary structure, ports between the pump chambers and cylinders, and valves controlling the ports and arranged to be operated by the pump pistons.

2. In an engine, the combination of a body consisting of oppositely disposed cylinders open at their outer ends, a common head for the inner ends of the cylinders, a web extending around the head, annular flanges extending in opposite directions from the web, admission ports in the web, and conduits between the ports and inner ends of the cylinders; a two-part casing having each part surrounding a cylinder and fitting an adjacent annular flange on the said web and forming with the inclosed cylinder a pump chamber; pistons in the cylinders; pistons in the chambers connected with the first-mentioned pistons, mixture supply conduits connected with the chambers; and automatically attached suction valves controlling the said conduits.

3. In an engine, the combination of a pair of oppositely-disposed working cylinders, pistons mounted therein, cylinders surrounding the working cylinders to form separate annular chambers, annular pistons in the chambers and connected with the working pistons for pumping charges of mixture into the working cylinders, a crank shaft, and means for connecting the pistons with the shaft, with an auxiliary mechanism for driving the working parts of the engine, said mechanism comprising separate valve casings, ports between the casings and the said annular chambers of the engine to admit a starting fluid to the sides of the annular pistons opposite from those acting to pump the charges to the working cylinders, valves in the said casings for controlling the supply of fluid to the said annular chambers, means for supplying fluid to the casings, and means for actuating the valves.

4. The combination of an engine comprising a pair of working cylinders, pistons therein, a pair of larger cylinders connected with and surrounding the working cylinders to provide annular chambers, ports between the chambers and working cylinders, annular pistons in the chambers for forcing fuel charges through the ports to the working cylinders, means for connecting the two sets of pistons together, a crank shaft, and a connecting means between the shaft and pistons, with an auxiliary mechanism for driving the engine, said mechanism comprising separate valve casings, means for admitting fluid under pressure to the casings, exhaust conduits connected with the casings, ports between the casings and the annular chambers of the engine to admit fluid under pressure to act on the outer faces of the annular pistons, piston valves in the casings for covering and uncovering the ports, means connecting the valves to move simultaneously, and an adjustable mechanism between the valves and crank shaft of the engine to operate the latter in either direction.

In testimony whereof I affix my signature in presence of two witnesses.

ERNEST FRANKLIN.

Witnesses:
H. T. JOHNSON,
BARTLETT COLE.